

A Review on Storage of Pure Methane Gas in LPG Tank

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Abstract— This paper evaluates the use of renewable sources of energy i.e. biogas and suitability of a compact biogas system as a centralized decomposition of solid waste like kitchen waste and cow dung etc. and treatment option for the organic decomposition and fraction use of pure methane gas for the cooking, power generation purpose etc. This paper gives an idea and state of art innovations and research in the field of waste digestion and utilization of wasteful energy. In air-tight anaerobic digester bacteria were flourished and used for digestion of kitchen food waste and cow dung. Tremendous amount of Bio-gas was found to be produced which can be utilized for cooking or gas powered vehicles.

Keywords—Anaerobic Digester, Bacteria, Biodegradable Kitchen Waste and Cow Dung, Methane Gas.

I. INTRODUCTION

In today's fast moving world the resources are getting depleted due to their overuse though there rapid progress and development in all aspects as due to scarcity of petroleum and coal it difficult to supply fuel throughout the world also problem of their combustion lead to research in different corners to get access the new sources of energy, like renewable energy resources. Solar energy, wind energy, different thermal and hydro sources of energy, biogas are all renewable energy resources.

But biogas is distinct from other renewable energies because of its characteristics of using, controlling and collecting organic wastes and at the same time producing fertilizer and water for use in agricultural irrigation. Biogas is the product of the digestion of organic materials under anaerobic conditions. Biogas does not have any limitation and not require any technology to develop biogas, it is very simple to use and apply.

Biogas is product of biodegradable component and solid waste which substrate as manure, sewage sludge, municipal solid waste, biodegradable wastes or feedstock are transformed into methane and carbon dioxide. Purified methane gas can be used for the replacement to LPG gas.

Kitchen waste is organic material having the high calorific value and nutritive value to microbes, that's why efficiency of methane production can be increased by several orders of magnitude as said earlier. It means higher efficiency and size of reactor and cost of biogas production is reduced. Also in most of cities and places, kitchen waste is disposed in landfill or discarded which causes the public health hazards and diseases like malaria, cholera, typhoid. Inadequate management of wastes like uncontrolled dumping bears several adverse consequences: It not only leads to polluting surface and groundwater through leachate and further promotes the breeding of flies, rats and other disease bearing vectors. Also, methane which is a major greenhouse gas contributing to global warming.^[3]

Typical composition of biogas

- ❖ 50-75 % Methane, CH₄
- ❖ 25-50 % Carbon dioxide, CO₂
- ❖ 0-10* % Nitrogen, N₂
- ❖ 0-1 % Hydrogen, H₂
- ❖ 0-3 % Hydrogen sulphide, H₂S
- ❖ 0-2* % Oxygen, O₂

The process of anaerobic digestion is done by methane bacteria. Necessary conditions are:

- ❖ Anaerobic
- ❖ Temperatures between 15°C and 55°C
- ❖ PH-values between 6.5 and 8.0
- ❖ Avoiding retardants, such as heavy metal salts, antibiotics, disinfectants

II. EXPERIMENT SETUP

Principles of Production

Organic substances exist in wide variety from living beings to dead organisms. Organic matters are composed of Carbon (C), combined with elements such as Hydrogen (H), Oxygen (O), Nitrogen (N), Sulphur (S) to form variety of organic compounds such as carbohydrates, proteins & lipids. In nature MOs (microorganisms), through digestion process breaks the complex carbon into smaller substances.

The digestion process occurring in presence of Oxygen is called Aerobic digestion and produces mixtures of gases having carbon dioxide (CO₂), one of the main “green houses” responsible for global warming. The digestion process occurring without (absence) oxygen is called Anaerobic Digestion which generates mixtures of gases.^[2]

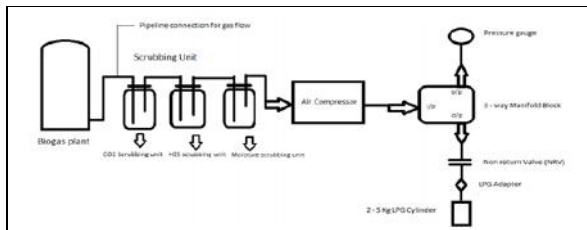


Fig.1:-Experimental setup of plant

III. CONSTRUCTION OF PLANT

1. Digester Tank

The amount of manure fed into a digester each day has an important effect on its operation. This is measured by volume added in relation to the volume of the digester, but the actual quantity fed to the digester also depends on the temperature at which the digester is maintained. In order to determine the unit size of a biogas unit, the following mathematical equation must be achieved:

$$\text{Digester size (m}^3\text{)} = \text{Daily feed-in (m}^3 \text{ day}^{-1}\text{)} \times \text{Retention time (day)}^{[7]}$$

2. Gas Holder

In which the produced biogas is stored, which is placed above the digester tank. Its construction look likes the digester tank. Output of digester tank is connected to the scrubbing unit.

3. Scrubbing Unit

The scrubbing unit is used for the separation of moisture from the biogas. There are three tanks. First tank separate the CO₂ gas and second tank separate SO₂ gas from the mixture of biogas. Then third tank is used for the removing the water particles from the biogas.

4. Compressor

The compressor is used to compress the pure methane coming from scrubbing unit. Compression is doing for storing of gas into the tank.

5. Storage of biogas

Biogas that has been upgraded to bio-methane by removing the H₂S, moisture, and CO₂ can be used as a vehicular fuel. Since production of such fuel typically exceeds immediate on-site demand, the bio-methane must be stored for future use, usually either as compressed bio-methane (CBM) or liquefied bio-methane (LBM) because most farms will produce more bio-methane than they can use on-site.^[4]

IV. METHODOLOGY

To conduct a detailed monitoring of the compact biogas plant, a fully operational unit will installing and operating in the campus of Bharati Vidyapeeth engineering college, Pune. However, this plant is operating on experimental basis and we are aiming to generate gas and store in the LPG tank for cooking purpose. We will allow flexibility in terms of changes in feedstock and on-site measurements of physical and chemical parameters of interest as well as gas production and composition. During the start-up period, the biogas plant will inoculated or fed with 50 kg of cow dung mixes with water. Thereafter, the plant has been left without further feeding for 45 days, in which only changes in gas production and composition were monitored. After 45 day the biogas plant was then fed with 1.5 kg/d used tea powder from canteen. The feeding rate of 1.5 kg per day has chosen because on one hand it represents a realistic quantity of organic waste produced by an average household and on the other hand it conforms to the reactor specifications.^[5]

1) Production Processes:

- 1) Manure collection
- 2) Feeding to digester
- 3) Anaerobic digester
- 4) Effluent storage
- 5) Gas Handling

V. CONCLUSION

The following conclusions are drawn from the study:

- 1) Effective mixing of extra bacterial seed improves digestion of waste and production of bio-gas.
- 2) It was found that the amount of biogas produced has increased by use of stirrer for homogeneous mixing of substrate with bacteria available in anaerobic digester.
- 3) It was found that the amount of biogas has increased with increasing proportion of cow dung in food slurry.

- 4) It is found that effect of mixing on an anaerobic digestion is advantageous on an effect of pH and effect of temperature.
- 5) Because in the effect of mixing with the help of stirrer, the contact between the substrates and the bacteria takes place in proper way due to that growth of bacteria as well as bacterial enzymes increases.
- 6) Separated methane gas is compressed by compressor and store in the LPG tank for further use.
- 7) Using the proposed method of Biogas compression system, the free natural fuel can be easily stored in cylinders.

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